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(54) **Current-conducting parts for plug-in fuses**

(57) A current-conducting part having two elongate contacts 5,6 connected by a fusible conductor 7 is punched out of a metal strip having a longitudinal edge region 1 of reduced thickness, from which the fusible conductor is formed.

FIG.5

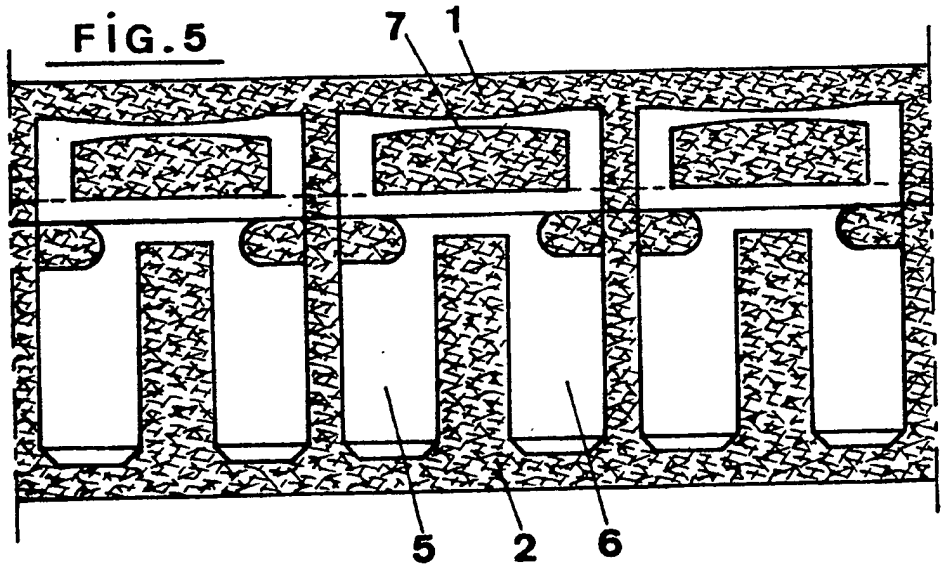

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FIG.1

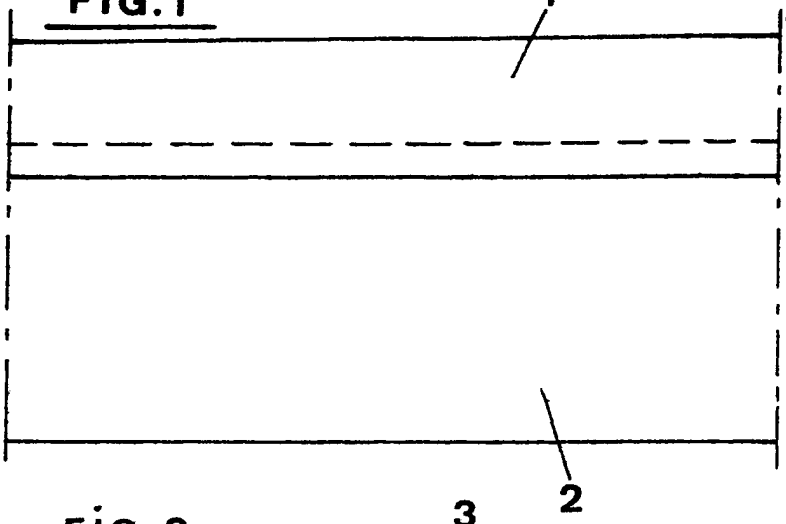

FIG.2

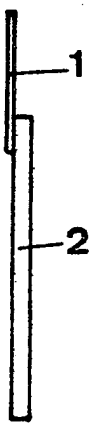

FIG.3

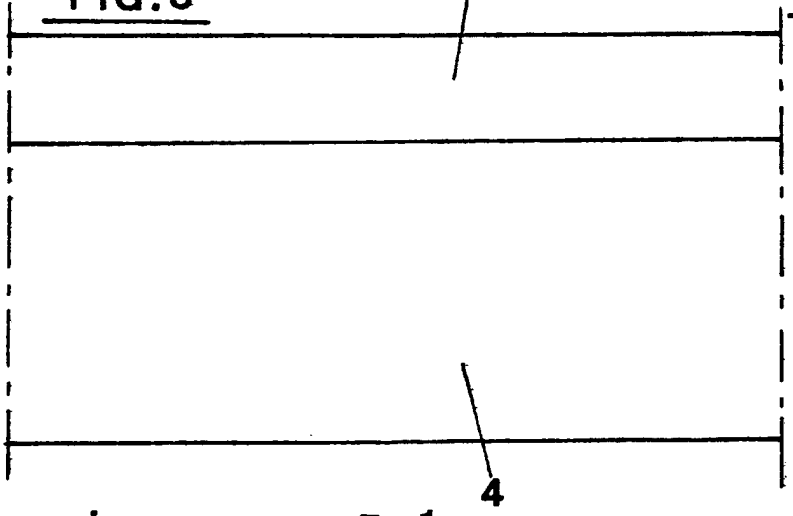

FIG.4

FIG.5

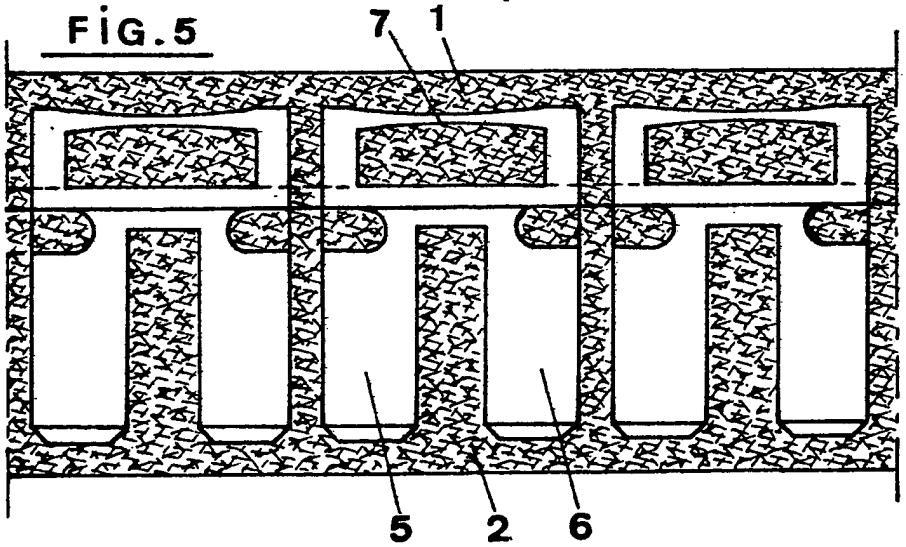

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FIG.6

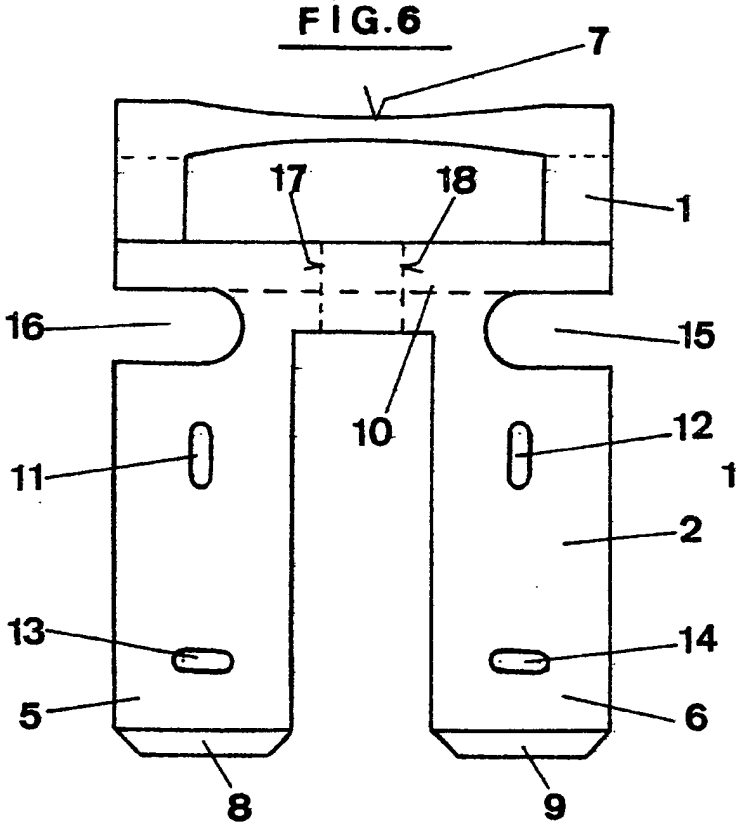


FIG.7

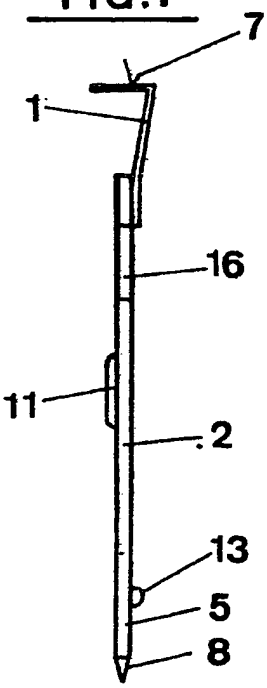


FIG.8

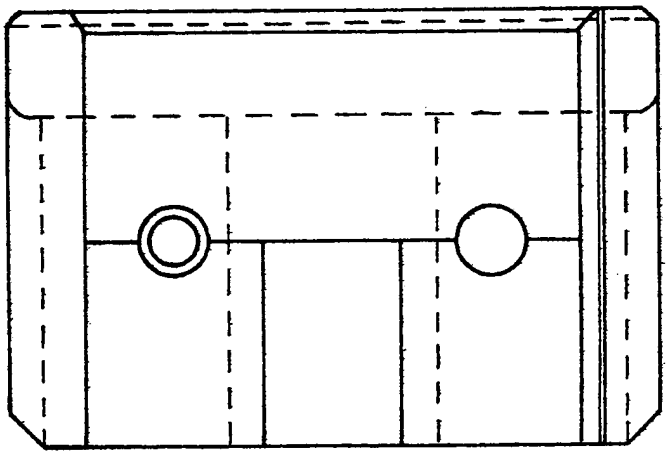
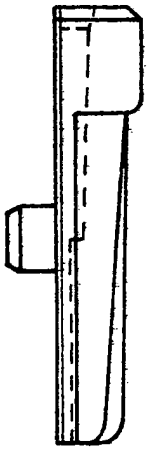


FIG.9



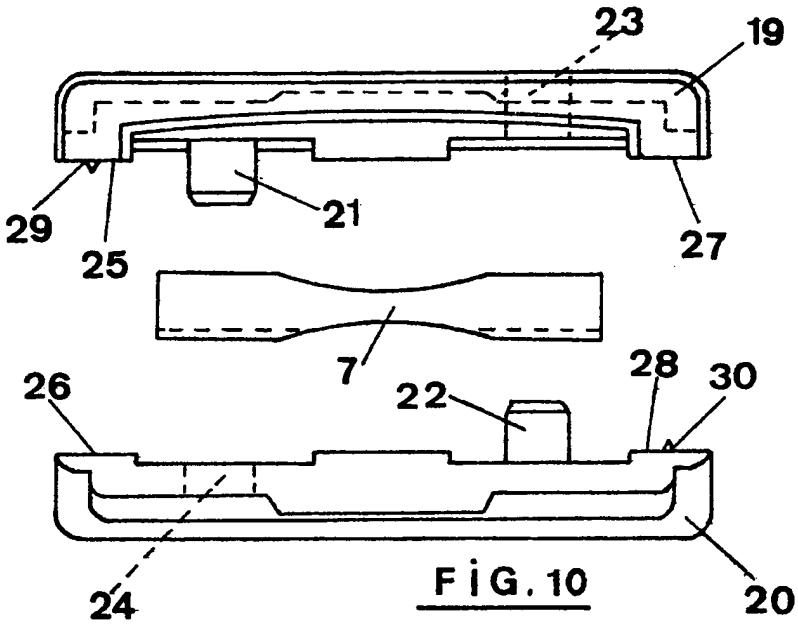
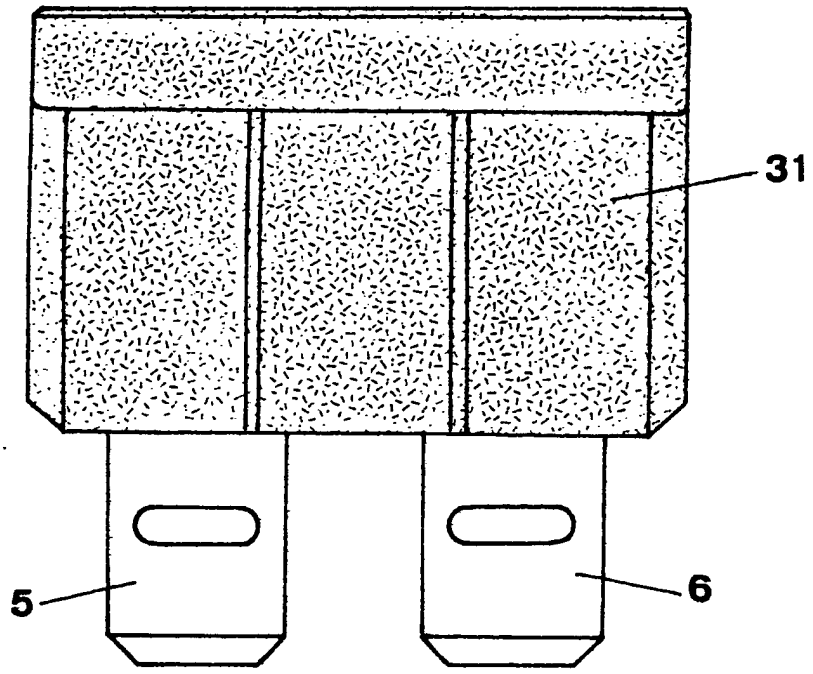


FIG. 10

FIG. 11



SPECIFICATION

Current-conducting parts for plug-in fuses

The invention relates to a plug-in fuse comprising a current-conducting part which is held in an insulating casing and which is provided with contacts which project from the insulating casing and which are connected to one another by a fusible conductor surrounded by the casing.

Plug-in fuses are already known in which each contact is a punched-out plate. The plates are inserted into the casing and the ends held in the casing are connected to one another by a fusible conductor.

It is also known to punch fusible conductors and blade-contacts in one piece out of a strip of fuse sheet. In order that the thickness of the fusible conductor should conform to the fusing value, the piece of punched-out sheet is subjected to subsequent machining in which the fusible conductor is milled thinner for example. Since the punched-out current-conducting parts are relatively small, for example plates 20 x 15 mm, the subsequent machining to reduce the thickness of material in the region of the fusible conductor to the fusing value of the fusible conductor is difficult.

The object of the invention is to simplify the manufacture of plug-in fuses.

The invention provides a plug-in fuse in which the current-conducting part is punched out of a strip of sheet which has a longitudinal edge region with a reduced sheet thickness.

The use of such a strip for manufacturing current-conducting parts has the advantage that the machining of the individual current-conducting parts to reduce the thickness in the region of the fusible conductor (in order to conform to the fusing value of the fusible conductor) can be dispensed with. The current-conducting parts may be successively punched out along the strip with regions of different thickness, it only being necessary to arrange the cuts of the punching tools in such a way that the areas corresponding to the fusible conductors are located in the strip edge region of a reduced thickness. It is possible, and may also be advantageous, for the strip to be a composite strip consisting of two different materials.

Current-conducting parts may be easily and simply produced from the strip in a successive operation, either by positive punching-out of individual parts or by negative punching-out in which a bridging member connecting the individual parts is left first of all and the individual parts thus arranged in the form of a connected row pass through subsequent processing stations.

The strip may be provided with the longitudinal edge region of reduced thickness by attaching a second thinner strip. The two strips may be joined to one another, for example, by resistance welding, ultrasonic welding, or laser welding. Alternatively, it is possible, to produce the longitudinal edge region of reduced thickness by machining the strip along one longitudinal edge region, for example by continuous milling. Again, it is possible to produce the longitudinal edge region of reduced thickness by a non-cutting process, for example pressing or stamping.

The current-conducting part is preferably U-shaped, the arms of the U being formed as blade-contacts and the bridge of the U being formed as the fusible conductor of reduced thickness.

When the current-conducting part is in its finished condition in the plug-in fuse the fusible conductor is the only metal connection between the two contacts. Owing to its reduced thickness the fusible conductor may not be suitable for carrying the contacts during assembly in the insulating casing in such a way that no bending occurs. It is thus provided, in a preferred embodiment of the current-conducting part, that the contacts are connected by a cross-piece which is arranged parallel to the fusible conductor and which is cut through only immediately before or during the insertion of the current-conducting part into the insulating casing. The edges and corners produced when the cross-piece is cut through act at the same time as mounting studs while fastening the current-conducting part in the insulating casing.

In the preferred embodiment, the arms of the U formed as blade-contacts each have at least one slot beginning at one edge, for example in the region of the cross-piece. These slots form points of enforced constriction by which zones of heat build-up are produced. At the same time the slots act as fastening apertures for the current-conducting part in the casing, if the casing is provided with projecting elements which may engage in the slots when the current-conducting part is mounted complete in the casing.

The insulating casing preferably comprises two approximately mirror-symmetrical half shells which may be joined to one another after the current-conducting part has been inserted. If the half shells consist of plastics material, they may be joined by welding or adhesion after the current-conducting part has been inserted. It is possible, alternatively, to make the insulating casing in one piece, for example of ceramic material, and simply to insert the current-conducting part from one side.

When using half shells of plastics material it is advantageous for each half shell to have a locking pin projecting towards the other half shell and passing through an associated slot or aperture in the current-conducting part. In this way the current-conducting part is securely fastened to the insulating casing.

The current-conducting part may also of course be provided with impressed longitudinal lugs or bosses in its upper region in order to increase stability and for fixing in the insulating casing. In particular, longitudinal lugs or bosses are advantageous when using prefabricated ceramic insulating casings. In addition, transverse lugs or bosses may be provided on the contacts, in order to prevent the inserted current-conducting part from shaking loose in a fuse panel.

On either side remote from the projecting contacts insulating casings are conventionally provided with an opening in which the fusible conductor is visible. For the purpose of rapid visual inspection of the

stat f the fusible conduct r it is provided that the fusibl c nduct r sh uld be made b nt. The fusible conductor is thus easily visible, being substantially perpendicular to the plane of th c ntacts.

It is also possible, of course, to punch out the current - conducting part with the contacts and the cross - piece from one strip of sheet and to form the fusible conductor from a wire or strip fusible conductor subsequently welded or soldered on.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which

Figure 1 is a front view of a metal strip (of indefinite length) consisting of two strips of different thickness welded together along their longitudinal edges;

Figure 2 is an end view of the strip according to Figure 1;

Figure 3 is a front view of a metal strip with an edge region of reduced sheet thickness produced by longitudinal milling;

Figure 4 is an end view of the strip according to Figure 3;

Figure 5 is a front view of a strip according to Figure 1 with current - conducting parts punched out;

Figure 6 is a front view of a punched - out current - conducting part;

Figure 7 is a side view of the current - conducting part according to Figure 6 with a bent fusible conductor;

Figure 8 is a front view of a half - shell of an insulating casing;

Figure 9 is a side view of the half - shell according to Figure 8;

Figure 10 is a front view of two half - shells of the insulating casing and a current - conducting part before assembly; and

Figure 11 is a front view of a complete plug-in fuse.

Part of a metal strip, out of which current - conducting parts of a plug-in fuse are to be punched, is illustrated in Figure 1. The strip is made of fuse metal and consists of two strips 1 and 2 of different thickness welded together along their longitudinal sides. The two strips 1, 2 may have any desired width and thickness, the thickness of the thinner strip 1 approximately conforming to the desired fusing value of a fusing conductor. Figure 2 is an end view of the composite strip, from which it can be seen that the strips 1, 2 are lap-welded.

Figure 3 shows a strip of fuse metal in which an edge region 3 for forming the fusible conductor is reduced in thickness by milling. The end view of Figure 4 shows that there is a step between the thinner fusible conductor region 3 and the thicker main region for forming the contacts.

Figur 5 sh ws th composite strip which consists f two strips 1,2 of diff rent thickness acc rding to Figur 1 and ut f which current - conducting parts of th contour indicat d may be punched in a continuous operation. The thicker strip 2 forms th tw blade - contacts 5 and 6 and the thinn r strip 1 f rms the fusible conductor 7.

Figure 6 shows one of the punched - out current - conducting parts, with the two contacts 5 and 6 having their ends 8 and 9 sharpened by bevelling. The current - conducting part is r ughly U-shaped, with the fusible conductor 7 forming the bridge of the U.

In order to facilitate assembly and to increase the stability of the current - conducting part during the entire machining operation, a cross - piece 10 connecting the two contacts 5 and 6 is initially left so that longitudinal bosses 11 and 12 and transverse bosses 13 and 14 may be pressed into the contacts 5 and 6 without special difficulty. In addition, slots 15 and 16 beginning at the outer edges of the contacts 5 and 6 are cut out during punching and form points of enforced constriction for heat build-up.

When the current - conducting part is inserted into an insulating casing the cross - piece 10 is cut through at cutting points indicated by broken lines 17 and 18. Figure 7 shows a current - conducting part according to Figure 6 immediately before insertion into an insulating casing. The fusible conductor 7 is, as shown, bent through approximately 90° in order to permit visual inspection of the condition of the fuse from above.

Figure 8 shows one half shell of an insulating casing consisting of two mirror - symmetrical half shells for receiving a current - conducting part according to Figure 7. The half shell is pressed or injection - moulded from an insulating material, for example plastics material. Figure 9 is a side view of the half shell. Figure 10 shows a top view of the two half shells facing one another and the current - conducting part (illustrated diagrammatically) immediately before assembly. The bent fusible conductor 7 of the current - conducting part is visible from above.

The half shells 19 and 20 have respective locking pins 21 and 22 which, when the half shells are joined together, pass through the slots 15 and 16 of the current - conducting part (Figure 6) and engage in receiving bores 23 and 24 opposite them in the half shells 19 and 20. The half shells 19,20 have pairs of bearing faces 25, 26 and 27, 28 facing one another, which are glued or welded together. For welding purposes the bearing face 25 of the half shell 19 and the bearing face 28 of the half shell 20 are each provided with a welding stud 29 and 30 respectively formed in each case as a rib.

A complete plug-in fuse is illustrated in Figure 11. In this embodiment the insulating casing 31 does not consist of two half shells, and is made of steatite. The current - conducting part as described above is inserted into the insulating casing 31 from above, so that the two contacts 5 and 6 project below.

CLAIMS

1. A method of making a current - conducting part for a plug-in fuse, the current - conducting part having two elongate contacts connected by a fusible conduct r, the method comprising th st ps of providing a current - conducting metal strip with a longitudinal edge region of reduced thickness, and punching the current - conducting part out of the said strip so that the fusible conductor is formed from the edge r gion of r duced thickness.

2. A meth d as claimed in claim 1, in which the said strip is provided by attaching tw strips

together.

3. A meth d as claimed in claim 2, in which one of th said two strips is thinner than the ther and xtends from one edge region of th other.

4. A method as claimed in claim 1, in which the said strip is provided with the edge region of reduced thickness by machining.

5. A method as claimed in claim 1, in which the said strip is provided with the edge region of reduced thickness by a non-cutting stamping process.

6. A method as claimed in any preceding claim,. in which the punched - out current - conducting part includes a cross-piece running parallel to the fusible conductor and connecting the contacts, the method including the further step of cutting through the cross-piece immediately before or during insertion of the current - conducting part into an insulating casing.

7. A method as claimed in any preceding claim, including the further step of bending the fusible conductor.

8. A plug-in fuse comprising a current - conducting part held in an insulating casing, the current - conducting part having two elongate contacts which project from the insulating casing and a fusible conductor which connects the contacts and which is surrounded by the casing, in which the current - conducting part has been punched out of a metal strip which has a longitudinal edge region of reduced thickness, the fusible conductor being formed from the said edge region.

9. A plug-in fuse as claimed in claim 8, in which the said edge region is constituted by a thinner strip attached to a thicker strip.

10. A plug-in fuse as claimed in claim 8, in which the said edge region is a machined region.

11. A plug-in fuse as claimed in claim 8, in which the said edge region is formed with a reduced thickness by a non-cutting stamping process.

12. A plug-in fuse as claimed in any of claims 8 to 11, in which the current - conducting part is U-shaped, the arms of U being formed as blade - contacts and the bridge of the U being formed as the fusible conductor with reduced thickness.

13. A plug-in fuse as claimed in claim 12, in which the arms of the U formed as blade - contacts are connected together by a cross - piece which is arranged parallel to the fusible conductor and is cut through immediately before or during insertion of the current - conducting part into the insulation casing.

14. A plug-in fuse as claimed in claim 12 or 13, in which the arms of the U formed as blade-contacts have at least one slot in each case beginning at one edge.

15. A plug-in fuse as claimed in any of claims 8 to 14, in which the fusible conductor is bent.

16. A plug-in fuse as claimed in any of claims 8 to 15, in which the insulating casing comprises tw half shells which are joined t ne another, with the current - conducting part inserted between them.

17. A plug-in fuse as claimed in claim 16, in which each half shell has a locking pin which projects towards the other half shell and which passes through an aperture in the current - conducting part.

18. A method of making a current - conducting part for a plug-in fuse, th method being substantially as described with reference to Figures 5 to 7 of the accompanying drawings.

19. A plug-in fuse comprising an insulating casing holding a current - conducting part made by a method according to any of claims 1 to 7 or claim 18.

20. A plug-in fuse substantially as described with reference to, and as shown in Figures 5 to 7 in conjuction with either Figures 8 to 10 or Figure 11 of the accompanying drawings.

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